

Technology Opportunity

Acoustic Micro-Dispensing

The NASA Glenn Research Center has developed a method of dispensing microscopic volumes of liquid. This is done by ejecting individual droplets of liquids or by forming a microfountain of liquid. The droplet volumes are measured in picoliters.

NASA Glenn is seeking specific applications for dispensing component liquids that become part of a microsystem. This includes coatings, inks, electrochemical liquids, and molten solders. NASA is also seeking applications for micromachining with process liquids. This includes etching, plating, and cleaning liquids used in the fabrication process.

Potential Commercial Uses

- Precise dispensing of liquid coatings, adhesives, inks, and slurries
- Maskless deposition and etching
- Precise placement of solder bumps and balls

Benefits

- Has no nozzles to clog or limit drop size
- Operates on demand
- Does not require any high-pressure systems
- Works under vacuum and at high temperatures
- Is suitable for conveyorized production
- Precisely controls size (between 25 and 250 μm)
- Precisely controls velocity (near zero possible)
- Is chemically compatible with a wide variety of harsh liquids

Microdroplet Dispensing

- Controls droplet size electronically
- Controls droplet ejection velocity electronically
- Ejects each droplet on demand
- Can eject hot, dense liquid metals

Microfountain Dispensing

- Controls contact on command
- Operates from a liquid pool
- Can be used individually or in arrays

- Can process small unmasked areas
- Works with process liquids too viscous to be ejected as drops

The Technology

Acoustic micro-dispensing uses acoustic radiation pressure to either eject droplets or form a low-velocity liquid fountain (Fig. 1). A transducer emits bursts of ultrasonic waves. Then, a focusing lens transmits the waves to the surface of a liquid pool, creating a radiation pressure zone. The pressure causes the liquid to rise and form droplets.

The size of the zone is proportional to the acoustic wavelength, and the drop size is proportional to the pressure zone, so drop size is controlled by frequency. Velocity can be controlled by amplitude and burst duration. Drop placement can match the accuracy of an inkjet printer. In addition, the ejection of hot liquid solder droplets has been demonstrated in a high vacuum (Fig. 2).

Microdroplet and microfountain dispensing overcome the limitations of small high-pressure nozzles and are clog free. The process has a number of variables that can be controlled independently, and it can be readily integrated with a computer control system. Etching and plating can be improved with microfountains because they create localized process zones that may eliminate the need for masking.

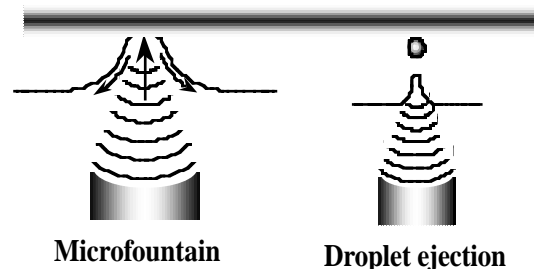
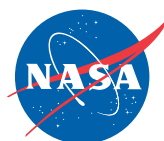


Figure 1.—Micro-dispensing.



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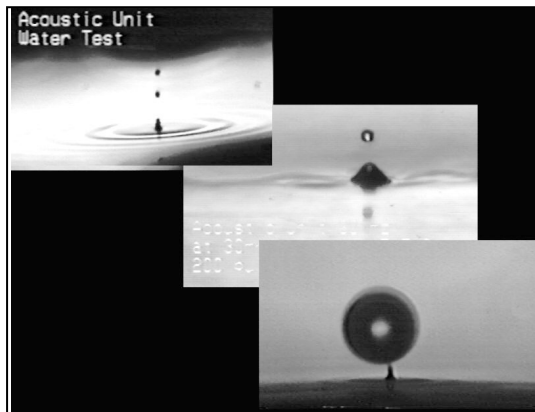


Figure 2.—Droplet ejection.

Options for Commercialization

- Three U.S. Patents are available for licensing.
- Two additional patents are pending.

NASA Glenn is seeking potential users with specific applications. Additional research and development are required to build a technology demonstrator for specific applications. Partnerships are anticipated with the electronics, microelectronics, and microelectromechanical systems (MEMS) industries.

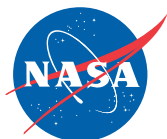
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Key Words

Microsystems
MEMS
Acoustic radiation pressure
Ultrasonic
Micro-dispensing
Directional electrostatic accretion process



National Aeronautics and
Space Administration
Glenn Research Center